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The viral content ratio between abdomen and head is informative of the relative efficiency with which *Bemisia tabaci* populations transmit begomoviruses

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Begomoviruses (family *Geminiviridae*) are transmitted by the whitefly *Bemisia tabaci* in a circulative non propagative manner. *B. tabaci* is a species complex composed of at least 24 morphocryptic species which differ in host range, insecticide resistance, endosymbionts and virus transmission. Begomoviruses are supposed to cross the gut barrier at the midgut level and salivary gland barrier in the principal salivary gland (PSG) cells because of the highest virus concentrations in these organs. Thus, the critical steps of the virus circulation in the insect body are (i) the exit of virion from the midgut, (ii) their preservation in the hemocoel and (iii) their entry in the PSG. Thus, we proposed that the efficiency of viral transfer from midgut to PSG may be assessed by measuring the viral content in both compartments and that the deduced viral content ratio may be correlated to viral transmission efficiency by the vector.

Our predicition was tested with two invasive *B. tabaci* species, Middle East-Minor Asia 1 (MEAM1), and Mediterranean (MED), and three begomoviruses: the invasive species Tomato yellow leaf curl virus–Mild (TYLCV-Mld), Tomato leaf curl Comoros virus (ToLCKMV), indigenous from Mayotte and R4, a recombinant between TYLCV and ToLCKMV.

In a first approach, PSG and midgut were separated by a cross section through the prothorax and viral loads were estimated in both sections by measuring viral DNA using real time PCR. As the midgut of *B. tabaci* was reported to be sometimes pushed through the diaphragm separating the abdomen and the thorax, the estimation of the viral content ratio between PSG and midgut may be biased by thorax sectioning. The simple cross sectioning was however validated because the ratio determined with such sections and the ratio determined after a careful gut dissection was similar. Using the simple cross section, the viral content ratio between head and abdomen was higher for MEAM1 than for Med for the three begomoviruses. As predicted, the transmission efficiency was higher with MEAM1 than Med Q2 for the three viruses.

These results indicate that viral content ratio may be a reliable predictor of the relative transmission efficiency between different *B. tabaci* populations. Measuring transmission efficiency is time consuming, involves technically difficult experiments with acquisition and inoculation steps and needs specialized cage and containment equipment. However measuring viral content ratios needs only a few cages for the acquisition step, a binocular lens and an access to the commonly used qPCR machines. This approach might be extended to estimate the relative transmission efficiency of other circulative non propagative viruses.